

**A Progress Report**

**Grant No. N00014-94-1-0841  
June 20, 1994 - February 14, 1995**

**SOFTWARE FOR ADVANCED VISION SYSTEMS**

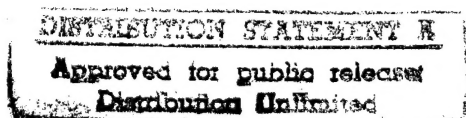
**Submitted to:**

**Dr. Thomas M. McKenna  
Code 342CN  
Office of Naval Research  
800 N. Quincy Street  
Arlington, VA 22217-5660**

**Submitted by:**

**Thomas J. Olson  
Assistant Professor**

**SEAS Report No. UVA/525488/CS96/101  
July 1995**



**DEPARTMENT OF COMPUTER SCIENCE**

**19960415 033**

**DTIC QUALITY INSPECTED 5**

# REPORT DOCUMENTATION PAGE

Form Approved  
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE July 1995	3. REPORT TYPE AND DATES COVERED Progress Report 6/20/94 - 2/14/95	
4. TITLE AND SUBTITLE Software for Advanced Vision Systems			5. FUNDING NUMBERS N00014-94-1-0841	
6. AUTHOR(S) T. J. Olson				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) University of Virginia School of Engineering and Applied Science Department of Computer Science Thornton Hall Charlottesville, VA 22903-2442			8. PERFORMING ORGANIZATION REPORT NUMBER UVA/525488/CS95/101	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Office of Naval Research 800 North Quincy Street Arlington, VA 22217-5660			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION/AVAILABILITY STATEMENT Unlimited			12b. DISTRIBUTION CODE DISTRIBUTION STATEMENT A Approved for public release Distribution Unlimited	
13. ABSTRACT (Maximum 200 words) See report.				
14. SUBJECT TERMS			15. NUMBER OF PAGES 2	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT Unlimited	

# Software for Advanced Vision Systems

Progress Report - 6/15/95

Thomas J. Olson and Worthy N. Martin

The goal of the ARPA Advanced Vision Systems program (AVIS) is to develop hardware accelerators that will provide dramatic improvements in performance for machine vision, image processing, automatic target recognition, and other applications with similar processing needs. During phase I of the program our group conducted a study of software issues raised by the AVIS program. The goal of our current effort is to develop an abstract lower level interface for real-time computer vision accelerators. This interface will allow applications or development environments to control, sequence and synchronize with computations running on multiple accelerators without reference to vendor- or device-specific functionality.

## Activities to date:

We delivered the final Phase I report on April 15th. One of the lessons of that effort was the importance of supporting the Khoros image processing and visualization environment. During the past three months we have been working to understand the Khoros process model and identify the options for supporting it on non-standard hardware. We plan to use this information to constrain the design of the abstract low-level API.

Khoros 2.0 is a complete rewrite of the Khoros system. It is written in C, but uses function tables to implement essential object-oriented language features such as dynamic inheritance. Any approach to supporting Khoros on AVIS architectures will likely make use of these features for the sake of maintainability and compatibility with other Khoros code. There appear to be two basic strategies for accessing special hardware via Khoros. One is to create a subclass of the Khoros *node* type. Nodes in Khoros encapsulate the computational behavior of a dataflow graph operator. It would not be difficult to create a node that spawns child processes on an accelerator to do the bulk of its computation. The problem with this approach is that it would leave gross scheduling decisions under the control of the Khoros executive.

A second approach to using special hardware via Khoros is to override the behavior of the Khoros Workspace object. It should be possible to create workspaces that support unique sets of nodes and schedule them according to unique protocols (e.g. static dependency graph scheduling). The advantage of this approach is that it should make it possible to use Khoros operators implemented as conventional workstation executables in combination with those that target an AVIS accelerator. This in turn would provide a smooth path for transitioning existing applications to the accelerator: Khoros operators could be recoded for the accelerator one at a time, providing incremental performance improvements.

The main technical problem that we see concerns the difficulty of using multiple accelerator-based workspaces in a single application. The low- and intermediate-level software for some AVIS accelerators may require a global view of the computation, e.g. in order to perform static scheduling and resource allocation. Khoros is currently conceived as a highly dynamic system in which decisions of that type are made at run time. We are currently designing a Khoros interface to our statically scheduled VEIL system, in order to ensure that the approach we choose can meet these requirements.

## DISTRIBUTION LIST

- 1 - 3      Dr. Thomas M. McKenna  
             Code 342CN  
             Office of Naval Research  
             800 N. Quincy Street  
             Arlington, VA 22217-5660
- \*            SEAS Postaward Research Administration
- 4 - 5      H. Earnhardt, Clark Hall
- 6           Director  
             Naval Research Laboratory  
             Washington, DC 20375
- Attention: Code 2627
- 7 - 8      Defense Technical Information Center  
             S47031  
             Building 5, Cameron Station  
             Alexandria, VA 22314
- 9           Mr. Michael Karp  
             Administrative Contracting Officer  
             Office of Naval Research Resident Representative  
             101 Marietta Tower, Suite 2805  
             101 Marietta Street  
             Atlanta, GA 20323-0008
- 10          SEAS Preaward Research Administration

JO#6500:ph